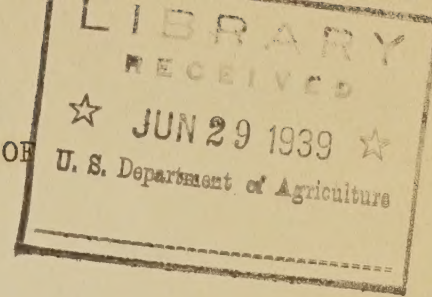


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RESULTS OF SURVEYS ON RESEARCH IN THE USES OF
ELECTRICITY IN THE DAIRY AND POULTRY
INDUSTRIES.



Harry L. Garver, Bu. Agr. Eng., U.S.D.A.
Given before Rural Electrification Division, A.S.A.E.
St. Paul, Minnesota, June 22, 1939.

Last year there was set up in the Bureau of Agricultural Engineering a research project in rural electrification. The project as planned was believed to be broad enough to include practical, every-day problems and also studies of a more fundamental nature, the results of which, it is hoped, will have some influence upon the future use of electricity on farms.

The project has as its objective a study of uses that will pay, or at least give promise of paying, their own way and perhaps also net a profit, keeping in mind the low-income farm. As the building of rural power lines reaches the less prosperous farmers, the problem of finding, or developing uses of electricity that aid in increasing income gets more and more exacting upon the investigator. Not only must equipment of a readily adaptable and practical nature be developed, but studies must be made which will lay the foundation for developing equipment for the future.

We, who are committed to carry on research in rural electrification, have the responsibility of keeping a jump or two ahead of the desires of farmers if mistakes are to be avoided. This, we have in part been able to do. In fact, electrification is one of the few farm enterprises in which research has kept apace with, if not ahead of development. Perhaps, the fact that there has been so little backing up in rural electrification is due in part to the activities of research agencies. Whether or not research will keep ahead in the future depends on whether properly qualified research work-

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ors are provided in sufficient numbers to keep pace with the extension of rural electrification into new areas.

In the Bureau's effort to reach its objective it has set up several goals, the first of which is to survey and collate information on research, both active and completed, on agricultural enterprises in which electricity plays a part. Second, to make case studies of actual farms in various parts of the country and by careful analysis, discover how the farm program may make the use of electrical appliances profitable, or as a corollary to that study, a study of the appliances themselves, to see how they may be modified or developed to fit into the present farm schedule in such a way as to make them profitable to the farmer, keeping in mind always, safety, convenience, beauty and the fact that we must concern ourselves with the low-income farm. Third, as previously stated, to study the more fundamental problems, such as those relating to the influence of electricity, light, heat and magnetism, and other associated phenomena upon plants and animals.

We have been at this job only since last September and have spent part of the intervening time in perfecting plans and organization for undertaking this ambitious program. Our first efforts were bent in reaching the first goal. This we have partially done and a start has been made toward the second by making arrangements for cooperative studies with three Agricultural Experiment Stations and starting case studies. The third is as yet mostly in the future.

The new project offers something of a challenge. Early investigators, although concerned with the economics of rural electrification, spent the greater part of their time and effort developing new uses and revamping exist-

and the possibility of a further extension of the existing

of the existing conditions.

It is the purpose of this report to present the results of the

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ing equipment to operate with electricity on farms reasonably able to absorb the added expenses. Even here all was not "free wheeling". And now, with electricity out there on the doorstep of folks, who, at some times of the year wonder from whence the next meal is to come, the problem is more puzzling than ever. Of if, perhaps, the larder may provide salt pork and sow belly, and where pellagra and other dietary disorders are rampant, either through lack of funds or ignorance, how do you and I fit into the picture? What assistance can we give? The problem is in our laps.

Let me go back to the first goal, which is to yield the subject matter suggested by the title of this paper. Between January and May of this year, we have had men, whom we borrowed from agricultural colleges, visit agricultural experiment stations and collect available data and publications on investigations and research in applications of electricity in the poultry and dairy industries. These men talked to research workers in agricultural engineering, poultry husbandry and dairying, and also to extension men, gathering from them not only facts about their studies, but statements of their experiences in these studies which are seldom published, but sometimes are of more value than the actual data. It may be interesting to note here, that from these conversations it was evident that men at the same institution, interested in the same things were frequently surprised at how much the other fellow knew about his field, also how infrequently many of them pooled their interests and efforts in attempting to reach a solution to a problem.

All too often, opinions of individuals at the same institution were found to be diametrically opposite. Occasionally data could be found to

substantiate both arguments. What was the difficulty? To the outsider it looked as though the two had not put their heads together before the experiment started. As long as there is a difference of opinion concerning a problem that lends itself to solution, there is a job for research men, but a look at the field does not suggest a likelihood of research men working themselves out of a job even if they get together and plan their programs in such a way as to answer the questions without so many if's, or loopholes: "Under the conditions of the experiment results were so and so".

We must not conclude from this statement of diverse opinions that there is no agreement on the part of investigators - there is - and lots of it, both on the results of experiments and also on research procedure.

In many institutions two or more divisions get together in planning certain projects. This is a healthy, unselfish and profitable way to attack a problem. The prejudiced and jealous attitude taken by some departments in planning projects where electricity is involved has left the Agricultural Engineer "standing at the station when the train pulled out." Must he push himself into the jam in order to get aboard? It seems that way - at least until he has convinced the other fellow that he has something to contribute. Fortunately, rural electrification men have been able to win the confidence of other divisions and have been accepted on equal level as project directors at many stations.

It would be impossible in the short space allotted to this paper to discuss each of the several applications of electricity in either of the poultry or dairy industries. Reference will be made only to those outstand-

ing applications and to statements concerning them.

Barn Lighting: The one interesting thing about the lighting of dairy barns, in fact, the lighting of all farm buildings aside from the home, is that at least eight states are making recommendations, while only two have done any research, and their studies have been mostly in the use of ultra-violet radiation. Nobody knows just how much light is best for the dairy barn. We assume that it should be sufficient to enable the worker to move about and perform his regular tasks efficiently. Is that all, we may ask? What effect has light on the cow? Would a soothing light encourage her to yield her milk more willingly? What kind of light is soothing to a cow? What, if any, physiological effect does it have?

Wiring: Types of wiring are also recommended without a research background. Several stations have made observations, but no formal research project has been set up as revealed by the survey. One of the interesting things about wiring in particular is that nearly all of the stations are agreed that "B.X." or flexible metal-covered cables should be eliminated from farm building wiring. There is a sympathetic feeling toward the fellow who advocates non-metallic sheathed cable.

Water Systems: No definite research on water systems was reported, although many states report an extensive use of running water with drinking cups in the barns. Only three, so far as our survey has been tabulated, have shown any hesitancy about recommending drinking cups, and these do not recommend them because of the possibility of freezing and thus causing trouble. The cost is rather high for small dairies and especially so

when one cup is provided for each cow. Some states recommend one cup for each two cows; while others believe that this practice is conducive to the spread of diseases.

Warming Drinking Water: Warming of water is definitely recommended by but four of the twenty-seven states visited. Six of the states feel that warming the water has an advantage in that it prevents freezing and that this is perhaps its only advantage.

Milking Machine: One application about which there is a great deal of controversy is the milking machine. The milking machine is used in practically all of the northern and in many of the southern states visited. The principal objection to the milking machine seems to be that it is unsanitary, not so much in itself, but that it is frequently improperly cleaned and sterilized. Several men hold to the idea that it is responsible for the spread of mastitis, and that if it is used, it must be used under good supervision. In reviewing the statements brought in by the surveyors I find but one state definitely recommending the use of the milking machine.

Dairymen have a variety of ideas as to the size of dairy herds necessary for profitable use. The lowest number of cows suggested was eight to ten; while the highest was thirty. The majority of those giving an opinion on this matter stated around fifteen. Portable milkers may be considered as temporary appliances and in most dairies, where milking machines become a part of the regular dairy equipment, pipe-line types are installed. Studies made on the energy requirements of milking machines revealed that 2.93 kwhr of electrical energy were used per thousand pounds of milk drawn

when the herd consisted of an average of 38.7 cows. In another test of five herds averaging 35 cows each the energy consumption was 2.56 kwhr per cow per month, or 4.5 kwhr per thousand pounds of milk.

Food Grinding and Mixing: Reports of the grinding and mixing of feeds on the farm showed that few states recommend them, and that they are really not being done very generally. Three states have had definite research projects on the problem. In New England, both home grinding and custom grinding by traveling grinders are going out. Where mixing is done the majority of it is done on the barn floor with a shovel. Farmers don't see the advantage of grinding unless it is ground fine and as a result home grinding is very frequently done too fine. Some states believe there is room for a lot of study on all kinds of food preparation.

Silo Filling: Many states are cutting silage, but here, too, we see a shift from corn and other materials commonly used for silage to grass silage. Whether or not this is a fad remains to be seen. The part that the cutting of grass silage will have on the use of electrical power is problematical. The tendency is to recommend the use of all-crop machines which chop, crush or grind the material as it is cut in the field and load it onto wagons, ready for elevating to the silo. Should this practice become popular, then a small motor with a drag-type elevator or similar device would be satisfactory for filling the silo, and would probably be used to a considerable extent, because the tractor would be busy in the field. At the present time jobs as heavy as silo filling are done mostly with tractors.

One dairy husbandman believes that we are passing through a revolution-

ary process in trying to preserve hay crops. Drying, making silage of grass, chopping hay and so on, are but stages in this revolutionary process. There is also need for more knowledge in the handling of molasses.

Hay Chopping: Hay chopping seems to be losing out in some of the states. The greatest advantage in using chopped hay seems to be from the handling standpoint. It does increase consumption according to the belief of some, but grinding is too expensive and not worth the cost. The practice of cutting may be justified in the case of high-priced hay or where hay may be very scarce, then chopping is an advantage, as was the case during the drought of a few years ago. One of the principal difficulties associated with the chopping of hay is that of getting rid of pieces of iron and nails, which, as you well know, are the cause of considerable loss to dairymen. This is a real problem, as expressed by several states. Harrison of New York, believes that the chopping of hay makes it less palatable, especially timothy. He also comments that a cow has teeth for the purpose of chewing and has lots of time to chew.

Hay Hoists: There are differences of opinion also on the use of feed handling equipment, hoists, elevators and so on. The need for hoisting hay will decrease with an increased use of grass silage. Some believe that the cost of the electric power-driven hay hoist is too great and farmers will not pay for it so long as they can hitch a team to the end of a rope, but admit that hay hoists are well liked where they are used. If the use of the pick-up baler becomes more popular it may have some influence on the use of hay hoisting devices. Not many feed elevators are used, except in the

corn belt.

Pasture Irrigation: Pasture irrigation is another application of considerable interest to me. Very few of the states visited had anything to say about it. However, four of them have actually done some research and believe it may be practiced profitably in certain areas. Wisconsin doubled production even in a humid year. Another state believes that it has considerable possibilities.

Electric Fence: We come now to the electric fence. Most of the states visited have electric fences. Five of them are making definite recommendations. The most useful place for the electric fence, according to those reports, is in the control of pasture rotation, where it seems rapidly to be replacing other types of fence. Ohio says that they get more inquiries on electric fence than on any other electrical appliance on the farm. A few dairymen use the device in their barns to prevent "gutter parking".

Milk Cooling and Refrigeration: A great many things may be said about refrigeration; in fact I think more dairy husbandmen and agricultural engineers expressed their opinion on this than on any other application in the dairy industry. The trend in refrigeration is towards commercial units and away from concrete tanks. Sixty to eighty-five per cent of farmers having electricity in the Southern States use some type of mechanical refrigeration. Most of the states recommend wet storage. Wholesalers generally use wet storage, while producer-distributors use either direct expansion or brine type aerators and dry, walk-in storages.

Not many direct expansion aerators are used, but there seems to be

some shift toward them. They are used principally by producer-distributors and have a very definite place in the cooling of morning milk. An interesting fact about the ordinances of certain states with respect to the use of aerators is that even neighboring communities sometimes require or prohibit the use of aerators. This fact leads extension and dairymen to wonder if there are not still sufficient problems involved to justify research. This is true not only of aerators but of the efficiency of cooling tanks with agitators, lengths of coils and so on. Patents sometimes dictate what shall be done and arguments are presented to justify the use of all kinds of equipment. It is difficult sometimes for us to sort out the points that really are experimental facts from those that are statements designed to aid in making sales.

Records kept in one state show an energy consumption of 1.18 kwhr per hundred pounds of milk in wet storage, and 2.5 kwhr per hundred pounds of milk when both aerators and dry storage were used. Milk cooled over aerators and sold directly required 0.68 kwhr per hundred pounds. No data seem to have been presented which show advantages of brine over "sweet water" or vice versa. Most of the aerators using one or the other do so because of the aggressiveness of the salesman of that area.

As previously stated, most dairymen opened their hearts on this subject and with your permission I should like to quote some of them without mentioning their names: "The cooling of milk does not improve but merely aids in retaining of quality." "If quality milk is not produced no amount of refrigeration will improve it." Another statement that was made may be

open to challenge, and that is, "Farmers produce quality milk to avoid punishment." If this is wholly true, then I confess I do not know the solution. The statement is also made that "the premium basis is not a satisfactory method of encouraging farmers to produce high quality milk. It only sets up a standard for a trade area." This same gentleman makes the statement that "creamers are the cheese factories of the farm."

Water Heaters and Sterilizers: Water heaters and sterilizers are usually spoken of as load builders. They are, however, not very much used and not very largely recommended by the extension forces of the various states visited. Many of the men expressed an opinion that there is a great need for a practical, low-priced sterilizing unit. There is still some question, however, as to the best method of sterilizing. Some states require chemical sterilization. In many parts of the country steam is relied upon for this purpose. Some work is being done with the "sterile" lamp. Regardless of how sterilizing is done, there has been an expression of desire for having it done quickly and easily. There is not much difference north, south, east or west on the sterilizing situation. In some states household types of water heaters are used for furnishing hot water to the dairy, but in most of the larger dairies steam boilers are used for this purpose. There is still a great deal of room for improvement and education. One problem that has been expressed more than any other is that concerning a rubber that will stand the heat treatment necessary for sterilization. This problem could probably best be worked out in cooperation with one of the chemical concerns manufacturing rubber tubing.

Separating and Churning: It was a surprise to me, having grown up on a farm where we did our own separating and churning, to find so many states where separating is almost a strange word. Many of the states visited had no report on them. Only two states indicated that they were used in any considerable numbers, and five of the states visited said definitely that they were not used to any great extent. The statement was made in Minnesota that they are universal there; while in Wisconsin there are but few used. Michigan states that about 30% of their dairy farms separate milk on the farm.

Churning is very much in the same category. Michigan stated that 1/10 of 1% of their farmers do their own churning; while Minnesota also says that churning is negligible. Four only, out of a class of 75 students of the University of Minnesota, reported butter-making at home. Wisconsin says that churns on the farm are rare. One extension man says that he has not seen a churn on a New Jersey farm in ten years. Pennsylvania farmers, on the other hand, market about one million pounds of butter annually.

A desire is expressed for some research in sonic and supersonic vibrations in certain processes in the dairy industry. Sonic waves, I understand, have some influence on the curd tension of milk. The suggestion is also made that some electrical therapy on cows' udders may have a place on the dairy farm.

Space and time do not permit our going into a discussion of applications of electricity on the poultry farm. But, in a general way we may say that in the poultry industry as in the dairy industry there are still many problems awaiting solution. We are, in a great many cases, attempting to rebuild our equipment on the same lines as those used with other forms

of energy.

One thing further that was very definitely pointed out by men at many of the stations visited, particularly the poultrymen - we must not delude ourselves into thinking that electricity may be credited for advances made in many enterprises around the farm for which we rural electrificationists so frequently push out our chests. Good management plays a big part and the poultryman will tell you so. He will go so far as to tell you that by breeding, selection, choosing correct hatching dates, and with proper feed and care, he can make his hen lay when he wants just as well without lights as with them. Opinions are changing about artificial lights giving hens more time in which to eat, assuming that they will eat more and as a result be forced to lay more. Poultrymen are beginning to believe that light has some sort of stimulating effect on the reproductive organs which causes the hen to lay more and as a result of greater production she must eat more. It requires no difficult stretch of imagination to believe that similar stimulation can be effected by foods and care. We are forced to the place where we must prove that such stimulation can be done more effectively and economically by lighting than it can be done by other means, if our lighting of laying houses is going to remain one of our strong selling points in rural electrification. Parallel also with the development of electric brooders has come a greater consciousness of proper care and generally increased intelligence in poultry management. Those have had their influence and unless we as research men, leaders in rural electrification, as we are frequently called, are sure of our

grounds, we are in a vulnerable spot. If too much is taken for granted, we may some day find ourselves "out on a limb". We may observe what John Jones is doing and write a good story about how he made electricity pay by applying it to a hive of bees, making life around there so uncomfortable for sleeping that even the drones got out and helped make honey. Should it happen that Bill Brown's drones would rather crawl into some hollow tree to sleep, the neighbor who hears the story is going to doubt not only you, but John Jones as well.

Many years are required for the acceptance of new ideas and the adoption of new methods. Naturally, there is resistance to the purchase and use of new equipment that requires changes in habits and ideas. Electrification of the farm is no exception to this rule. Let us look at one of Oscar Meier's pots - changing the size and form of the cream can - and see how difficult it would be to change its form. The number of manufacturers concerned with such a change reaches far beyond the one which makes the can. Strainers, racks, truck bodies, washers, sterilizers and refrigerators may all easily be affected. Oscar's problem, however, would not necessarily change the refrigerator but would make the present domestic refrigerator suitable for storing cream. But somehow I feel that we must start from scratch and rebuild in a great many cases, if we are to make electrification of the farm a profitable enterprise.

We are, in our electrification of farms, where the manufacturers of tractors have been for a long time. Man started out in the dim past dragging a stick behind him in cultivating his ground. After a time he

learned how to hitch that stick behind an ox and then the horse, and when he got his tractor he still hitched his cultivating tools behind it, which is about the way we are doing with some of our electrical equipment.

